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MODELS OF MEANING AND THE ANALYSIS OF DELUSIONAL LANGUAGE.

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THE SEMANTIC ANALYSIS OF DELUSIONAL CONCEPTS IN THE INTERVIEW LANGUAGE OF PSYCHOTIC PATIENT IS DESCRIBED. THE TECHNIQUE IS BASED ON THE SEMANTIC DIFFERENTIAL DEVISED BY OSGOOD, SUCI, AND TANNENBAUM. COMPUTATIONAL PROCEDURES ARE USED FOR THE DETECTION OF CLUSTERS OF KEYWORDS. THESE CLUSTERS PROVIDE A "NATURAL" CLASSIFICATION OF PEOPLE AND EVENTS, AS THEY ARE DESCRIBED IN THE COURSE OF THE INTERVIEW. THE COMPUTATIONAL PROCEDURE, AS NOW WORKED OUT, IS CONSIDERED FULLY FEASIBLE AS A ROUTINE RESEARCH TOOL. THE USE OF THE SEMANTIC DIFFERENTIAL AND THE COMPUTER ANALYSIS OF RESULTING DATA IS ECONOMICAL IN HUMAN AND MACHINE TIME, AND THE SEMANTIC RELATIONSHIPS DETECTED BY THESE METHODS ARE NOT OVERT AND OBVIOUS. THE METHODS ARE WELL-SUITED TO INTENSIVE STUDY OF A SINGLE CASE. THIS IS A PREPUBLICATION DRAFT OF A PAPER TO BE PRESENTED AT THE ANNUAL MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (133RD, DECEMBER 29-30, 1966). (KL)

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MODELS OF MEANING AND THE ANALYSIS OF DELUSIONAL LANGUAGE[1]

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MODELS OF MEANING AND THE ANALYSIS OF DELUSIONAL LANGUAGE

This report is concerned with the semantic analysis of delusional concepts as they occur spontaneously in the interview language of a psychotic patient. An assumption which underlies our approach is that when a delusional statement occurs without prompting in the course of an interview, its occurrence is not a random pathological intrusion, but instead is meaningfully linked to the language which preceded it and to the language which followed. One of the important links between a delusional concept and other concepts in the same interview may be defined as a similarity in emotional meaning or affective synonymity. We will show how such affective relationships among a large set of concepts from an interview can be structurally represented as a model of emotional meaning.

One convenient and conventional measure of affective meaning, especially in its connotative or metaphorical aspect, is the Semantic Differential, a technique devised by Osgood, Suci, and Tannenbaum.[1] And, as such, the Semantic Differential technique seems a promising method for the study of psychotic language. It has been argued by Aleksandrowicz that schizophrenic language is most usefully interpreted as "metaphors which are charged with affective connotations,"[2] and Weinstein has extended this notion by defining delusions as "a form a metaphor... in which the patient portrays his problems and experiences."[3] In the case study we will report today, the semantic differential was used as a clinical research tool to help interpret delusional concepts on the basis of their emotional, metaphorical meanings for the patient.

We have selected, as an illustrative case, a 23 year old Army private --a white male born and reared in rural North Carolina--who was hospitalized with an acute delusional psychosis that developed after a year of active duty. At the time of his admission, the delusions which occurred were primarily religious and political in their themes. He believed he was a saviour and was destined by God to become President of the United States. He warned

that Communists had infiltrated his company and that World War III was imminent. He expressed fears that people were going to whip him and cut off his head because he was John the Baptist. Overt psychotic behavior disappeared two months after admission and the patient was released after six months to return to active duty. During the course of his hospitalization, the patient was interviewed on three separate occasions, each about a month apart, by a psychiatrist associated with our research project. The transcripts of these three interviews were the sources of our primary data.

The psychiatrist, who conducted the interview, read through each transcript and selected key words and phrases which he thought represented the content of the interview. In the particular interview we'll describe in detail today--the third interview--the psychiatrist chose 124 key words from the patient's language. These key words were then presented to the patient, along with enough of their surrounding contexts to identify the sense in which each word was used, and the patient was asked to rate each word on the semantic differential.

In Figure 1 we see the version of the semantic differential used in our studies. In its format, the semantic differential consists of a set of bipolar seven point scales, anchored by pairs of contrastive adjectives. The version shown here has 20 such scales, and the first scale is anchored at one end by the adjective "cruel," and at the other end by "kind." The patient's task was to define the meaning of a key word by placing a check mark on each scale. In the patient's rating of the key word President from the context--"I was going to be the President of the United States"--we see that the word was judged to be extremely "kind" and "straight" and "masculine" in meaning, but to be neither "timely" nor "untimely." The fourth position or midpoint on the seven point scale indicates meaninglessness or neutrality--that neither of the paired adjectives described the meaning of the key word. The seven point scale enabled the patient to describe intensity of meaning, in graded intervals or steps, with middle-of-the-scale judgments indicating low intensity or meaninglessness and response checks at the extreme outer intervals indicating high intensity. Here we have connected the check marks to graphically portray the semantic profile of the key word Presid[illegible].

The decisions required of the patient in rating a key word, such as President, are not merely artificial "paper-and-pencil" tasks, but do--in fact--tell us something about the way the patient responds to this word in other situations. There is, for example, a close, interlocking relationship between associative meaning, as measured by traditional word association techniques, and meaning as measured by the semantic differential. Numerous studies[4] have found that the way a person rates a word on a semantic differential form is significantly correlated with the way the person responds to that word when it is presented to him as a stimulus in a word association task. And some of our own studies[5] have shown that the meaning of a key word, as defined by the semantic differential, is reflected in certain formal characteristics of the sentence in which the key word is found embedded in the interview text itself. The affective meaning of a key word is related to such content-free, formal indicators as sentence length, the frequency characteristics of lexical choice, and the diversity of vocabulary within the sentence. We mention these studies to indicate how the semantic differential enables us to detect the involvement of affective processes in the making of complex language choices.

Once the patient has rated all 124 key words from his interview, it was possible to compare the emotional meanings of these words as determined from their semantic profiles. In Figure 2, we see the semantic profile of the key word guard from the context "I was on guard one night." It has been superimposed on the profile for President to show that the two profiles are quite similar. Similarity in the semantic profiles of two words is interpreted as indicating similarity in meaning, and we conclude that, for the patient, being President and standing guard duty were--in some sense and to some degree--equivalent in emotional meaning.

Figure 3 shows the semantic profile of the key word Communist from the context "I know there were Communists in our company." When the Communist profile is superimposed upon that of President we see marked dissimilarity, indicating that the two words were relatively dissimilar in affective meaning for the patient.

It simplifies the task of comparing the semantic profiles of key words if we represent the words as points in a geometric space. The distance between any two points in the space corresponds to the degree of similarity between their semantic profiles. Key words with similar profiles will be separated by short distances, while words with dissimilar profiles will be more distant from each other. Distances between pairs of words may be displayed in a distance matrix--an array of distances which resembles a mileage chart showing the distance between cities.

In Figure 4 we have arranged the distances among a set of selected key words to resemble a mileage chart. Here we see that the distance from Christian life to marijuana is 690 units, while the distance from Christian life to vision is only 60 units. Thus, Christian life and vision are similar in meaning, but both are dissimilar to marijuana. Closer inspection of this distance matrix reveals, however, that it has some special properties not usually found in mileage tables. In the main diagonal, running from the upper left-hand corner to the lower right-hand corner, are the zero distances, indicating that the key word most similar to another key word is itself, just as the city nearest to Washington is Washington itself. But notice that in each row of this matrix, when we start at the main diagonal and move to the right, the distances increase in size and then decrease again as we approach the diagonal from the other side. This arrangement of distances in each row is one of the properties of what is known mathematically as a circulant matrix.[6] In this particular matrix, the key word trouble refused to conform completely, but otherwise the ascending-descending order is preserved.

If we were to draw a map based on this distance matrix, the map would take an interesting form. It would be a circle, with the key words arranged around the circumference. This circular mapping, a sort of semantic wheel, is shown in Figure 5. Of the eight key words included in this figure, those which were most dissimilar in meaning (i.e., those separated by the greatest distance) are located across from each other on the wheel, while key words which were most similar in meaning (i.e., those separated by the shortest

distance) are immediately adjacent, or nearest neighbors. Thus, the key word marijuana from the context "He thought I was taking marijuana" is most similar in meaning to trouble--"I always start a lot of trouble... I'd deliberately start trouble"--and lie--"People said I wasn't living reality but that was a lie." In contrast, marijuana was most dissimilar to Christian life from the context, "Ever since I've been living a Christian life." Marijuana reflects some of the delusional content of the interview and its meaning may be interpreted as a blend of starting trouble and being accused of not living in reality and is quite incompatible with living a Christian life.

This structural modeling of semantic relationships among a set of key words can be used, then, to help interpret the personal meaning of concepts for the patient. However, we are severely limited in our choice of key words which can be located around a semantic wheel since their distances must fit into this rather rigid scheme of ascending-descending order. We need a somewhat more flexible framework for exhibiting relationships, but one which preserves the central notion of the semantic wheel--namely, the idea of neighboringness of words and their corresponding similarities in meaning. To achieve greater flexibility, we need a structural model with a greater number of degrees of freedom, a larger number of dimensions than the semantic wheel has.

At this point we return to the patient's ratings of semantic differential forms and observe a recurrent regularity. While our versions of the semantic differential consisted of twenty scales, the patient, in responding to these twenty, rated them as if there were basically only three. That is, there were three sets of interrelated or intercorrelated responses. For example, a check along the active-passive scale was closely related to where a check was placed on the slow-fast scale. A factor analysis extracted the three basic dimensions which the patient used in discriminating among the set of key words. The scales which were correlated with "good-bad" constituted the Evaluative dimension, the scales correlated with "hard-soft" was called the Potency dimension, and those correlated with "active-passive" made up the Activity dimension. It is very significant that these three dimensions --

Evaluation, Activity, and Potency--are consistently found in the factor analyses of semantic differential ratings. They are found in data obtained from respondents of differing ages, social classes, nationalities, and mental status--whether psychotic or normal. The dimensions are consistently obtained across people and across cultures and appear to have the rank of something approaching a semantic universal.[7] And, as we have noted, these were the dimensions used by the delusional schizophrenic in our study described here today.

The three dimensions provide a set of rectangular coordinate axes for representing the eight key words from the semantic wheel as eight points in a three dimensional semantic space. The most important of the three dimensions--the one used most discriminatively by the patient--was the evaluative or "good-bad" dimension. In Figure 6 we show the eight key words as points in a three dimensional semantic space and have color-coded the points to define the direction of the evaluative dimension. The red-colored points, on the left, are the four key words which the patient judged to be "good" or positively-valued in meaning. They include Christian life and vision. The blue-colored points, on the right, are the "bad" or negatively-valued key words: marijuana, trouble, lie, and fight. The important advantage of the three dimensional semantic space is that now we can easily include every one of our key words in the model and show at a glance their structural interrelationships.

Figure 7 shows a model of a three dimensional semantic space which contains all 124 key words of the third interview. Each ball represents a key word and is positioned with reference to a set of rectangular coordinate axes. These three axes correspond to the three dimensions of semantic space mentioned earlier. The evaluative meaning of a key word, whether it is judged to be "good" or "bad," determines its placement along the length of the model. The degree to which a word is "active" or "passive" (i. e., its activity) determines where it is located along the width of the model. And the potency of a word--its hardness or softness, strength or weakness--determines its height in the model.

Once we have geometrically represented key words as points in a semantic space, we see immediately that the points are not evenly distributed. Instead, there are clumps. Points tend to cluster together as densely-packed aggregates. Since points which cluster together in semantic space correspond to key words with similar profiles on the semantic differential, clusters may be said to represent groups of words which are similar in meaning.

The detection of clusters and the delineation of their boundaries is very useful in the study of interview language because clusters provide us with a classification scheme for categorizing the interview content. It is a "natural" classification, indigenous to the response data, not imposed externally from without. Cluster analysis thus may enable us to uncover the patient's own classification of people and events, as they are described during the course of the interview. The clusters give us content classes for succinctly summarizing the interview. They help us to identify the themes or concepts about which the interview is organized.

The computational procedures for cluster detection are quite simple and straight-forward and are available as a package of computer programs. So we will not describe them here, other than to say that the procedure, as now worked out, is fully feasible as a routine research tool.

Computer analysis of the patient's semantic differential ratings of the 124 key words from Interview III led to the detection of five well-delineated and interpretable clusters useful in summarizing the content of the patient's interview. For a cluster to be interpretable, a joint consideration of its key word composition and pattern of adjectival attributes must suggest a suitable characterization. Cluster interpretation is thus an exercise in inductive inference, and the content classes which result from the interpretation represent the hypothetical themes or key concepts around which the interview is organized. In Figure 7 we have color-coded the five clusters, with balls of the same color corresponding to key words which belong to the same cluster.

The red colored balls are located in the "good" or positively-valued region of semantic space, and correspond to key words referring to divine guidance of the patient's life. In this cluster, for example, is found the key word instrument from the context "The Lord was using me as his instrument."

The green balls identify key words which refer to the patient's mission in life. Here we find the key word job from the context "Every man's got a job to do" and the phrase planned for me from the context "I don't know exactly what the Lord's got planned for me."

The third cluster, color-coded in gold, contains key words referring to the patient's self-professed search for knowledge and godly wisdom. Among these key words were knowledge from the context "I was just bursting for knowledge" and the phrase learned a lot from the context "I've learned a lot since I've been here."

The orange colored balls identify key words which describe the patient's vigilance against danger, such a guard from the context "I was on guard one night" and the phrase locked and loaded from the context "I locked and loaded my weapon" and die from the context "I knew I was going to die so that I got up and fought it off."

The blue colored balls are located in the "bad" or negatively-valued region of semantic space and represent key words which refer to threats of violence and damaging forces. In this cluster we find the verb threatened from the context "A couple of guys threatened to whip me" and the noun knife from the context "He was talking about he had a knife on him." Also in the cluster we find a number of delusional statements such as "I felt that someone was watching me" and "I know there were Communists in our company" together with several references to the patient's psychotic episode--"I know I'm not insane" and "that was my first mistake--when I told him about my vision." The occurrence of these key words in the same cluster lends support to a clinical interpretation that the patient's delusional conviction of Communist infiltration and threatened seizure of power was an outward projection of an inwardly perceived threat of psychotic disturbance and loss of control.

The pink balls seem to separate the "good" and "bad" regions of semantic space as a sort of buffer zone, and it was difficult to assign these borderline points to any one of the five detected clusters. However, one of the computer programs in the package permits us to assign each of them on the basis of greatest probability of cluster membership.

The inter-point distances which are the basis for the detection of clusters in semantic space also enable us to examine - in close detail - the internal structure of a cluster.[8] In Figure 8, we have displayed the points which make up the "mission in life" cluster which - in the preceding figure was color-coded as the green balls forming the bottom layer of points in the positively-valued region of semantic space. Here the points correspond to key words and the interconnecting lines indicate pairs of points which are nearest to each other. Point 55 is the point closest to 77 in semantic space and the direction of the arrow indicates the direction of the relationship. The double-headed arrow which connects 55 and 77 means that the distance relation is reciprocal: 55 is the point nearest to 77 and, reciprocally, 77 is the point nearest to 55. Here we can see, for example, that for this patient, being a good soldier had strong religious connotations. It was closely linked in meaning with the phrases "The Lord's got a job for me to do" and "I don't know what the Lord's got planned for me." Being a good soldier was also related to the patient's intent to go back to school to finish his education at the completion of his Army stint. Finally, good soldier was similar in meaning to marching on the parade field. In Figure 9, we have entered the actual distance values above each line.

The three models we have described--the semantic wheel, the three dimensional semantic space, and the directed graph of the internal structure of a cluster--enable us to display the interrelationships among the key words of an interview. But, because the models are time-slices, representing the interrelationships as they existed at the time the patient rated the semantic differential forms, the models may be said to be essentially static representations, devoid of any dynamic properties. However,

there is reason for believing that the arrangement of words in semantic space exhibits certain structural characteristics which may influence shifts in the meanings of key words over time.

Returning to Figure 7 we see that the points on the left are more numerous and more crowded together than are the blue-colored points on the right. This change in relative density corresponds to the evaluative or good-bad dimension, with the positively-valued region more densely populated than the relatively sparse negative region. Those key words which the patient judged to be positively-valued were semantically similar to many other key words in the interview and belonged to large clusters which were tightly packed aggregates. In contrast, negatively-valued key words were widely dispersed and semantically isolated from other key words--even from those which were also negatively-valued. Furthermore, the "good" words were more intensely "good" than the "bad" words were "bad!" Negatively-valued words tended to be located near the origin or the center of gravity of the semantic space, and the region near the origin corresponds to meaninglessness. We believe that this thinning out in density from the "good" to the "bad" regions, with the "bad" words being less intense in meaning, is a general property of semantic space. For example, Figure 10 shows a three dimensional representation of an interview from another patient. Again, the positively-valued region (color-coded here in blue) is more densely populated than the negative region, color-coded in red.

The negative-valued words tend to share few semantic links with other words, and are relatively meaningless compared to positive words, which are enmeshed in a network of semantic relationships and are relatively intense in meaning. It follows that negative words should be more susceptible to change in meaning over time than are positive words. This hypothesis appears to be borne out in the case of the patient we have been describing today.

You will recall that three separate interviews were obtained from the patient. Key words were selected from each of these and each set of key

words was rated by the patient at three different times, about two weeks apart, designated T_1, T_2, and T_3.

We examined the shifts in meaning along the evaluative dimension by constructing turn-over tables, seen in Figure 11. There are two tables for each of the three interviews, showing the shifts from time one to time two, and from time two to time three. In the first turn-over table for Interview I, for example, the upper left-hand cell shows the proportion of key words which were "good" in meaning both at the time of the first and second rating. The lower right-hand cell shows the proportion of key words which were judged to be "bad" in meaning both at time one and time two. The other two cells are the "shift" cells. The upper right-hand cell shows the proportion of words which shifted from good-to-bad, and the lower left-hand cell shows the proportion which shifted from bad-to-good. The italicized numerals in the shift cells are measures of the rate at which words changed in evaluative meaning over time.[9] The other five turn-over tables are similarly interpreted.

First of all, it can be seen that "bad" words were more likely to become "good" in meaning, than "good" words were to become "bad." Thus tending to confirm our hypothesis--derived from the structural characteristics of semantic space--that "bad" words would be more susceptible to change. Secondly, the magnitudes of the shift were usually greater from time one to time two, than from time two to time three. There appeared to be a dampening effect over time, with the meanings of key words tending to stabilize. The stabilization is here associated in time with the remission of the psychosis. These findings suggest that if one of the tasks of therapy were to induce change in meaning, it would be easier to transmute a "bad" word into a "good" one, than to make a "good" word "bad."

This is one example of the applicability of semantic differential measurement and modeling to the clarification of a therapeutic issue. But there is a more general compatibility between this type of analysis and the objectives of clinical research. The general relevance may be summarized in five points:

PRESIDENT / COMMUNIST

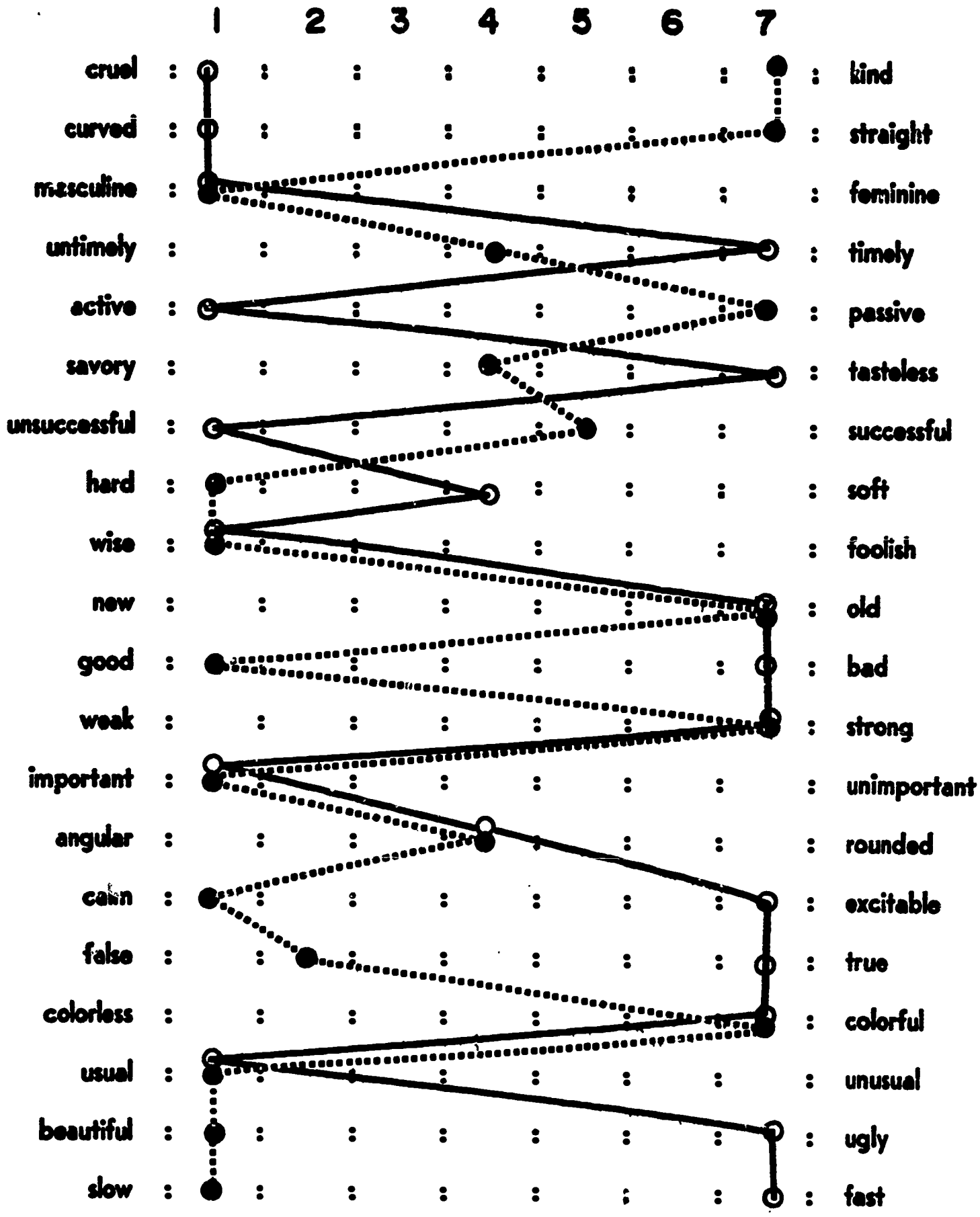

Figure 3

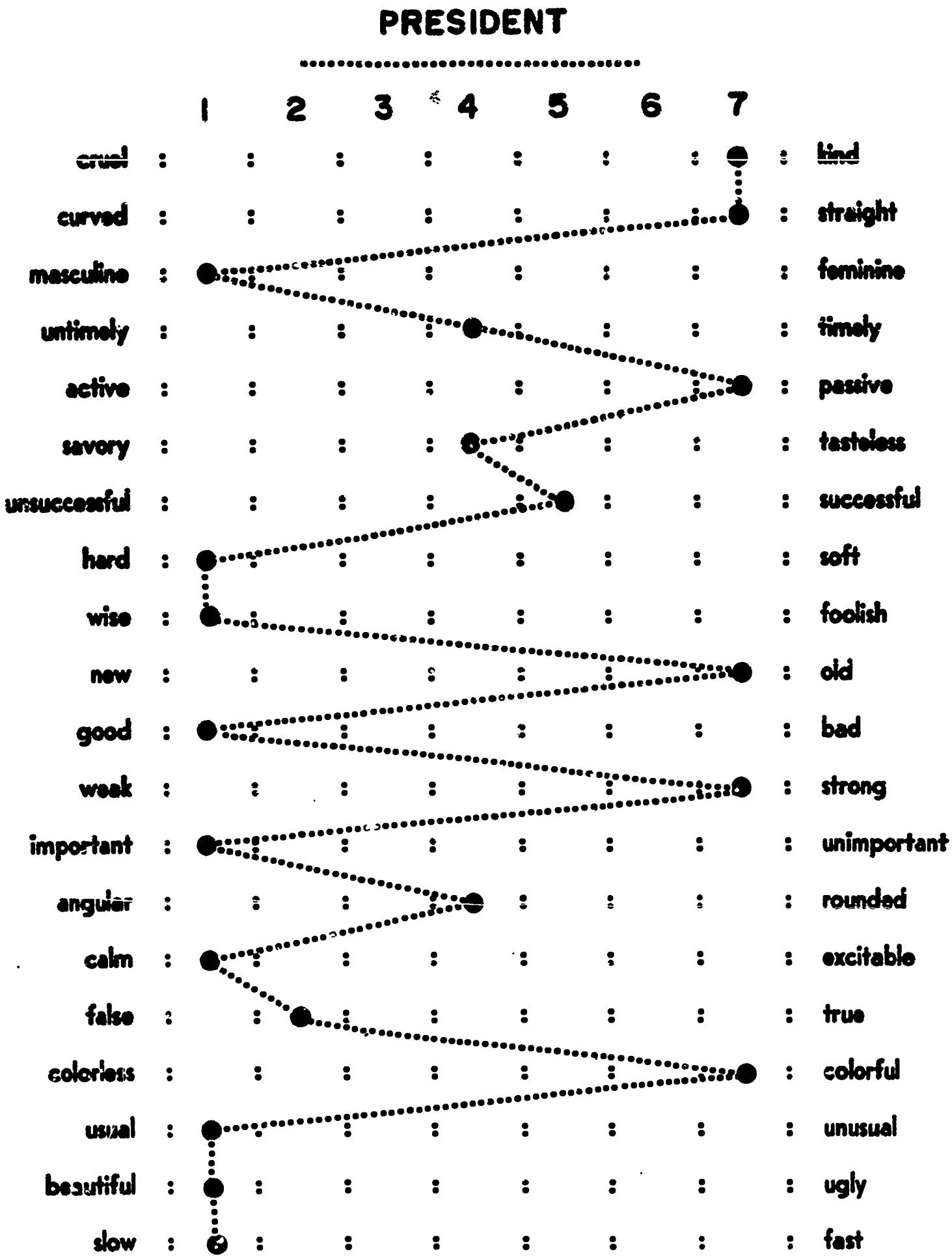
PRESIDENT
1
2
3
4
5
6
7
cruel
kind
curved
straight
masculine
feminine
untimely
timely
active
passive
savory
tasteless
unsuccessful
successful
hard
soft
wise
foolish
new
old
good
bad
weak
strong
important
unimportant
angular
rounded
calm
excitable
false
true
colorless
colorful
usual
unusual
beautiful
ugly
slow
fast

Figure 1

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A program package for the cluster analysis of semantic differential data, using the IBM 1401, is listed in the IBM Catalog of Programs under the title "Classification Using Rating Form Data," File Number 14.01023. A description of these programs may be found in the IBM Application Brief, "Computer Assisted Language Content Analysis at Walter Reed Army Institute for Research."

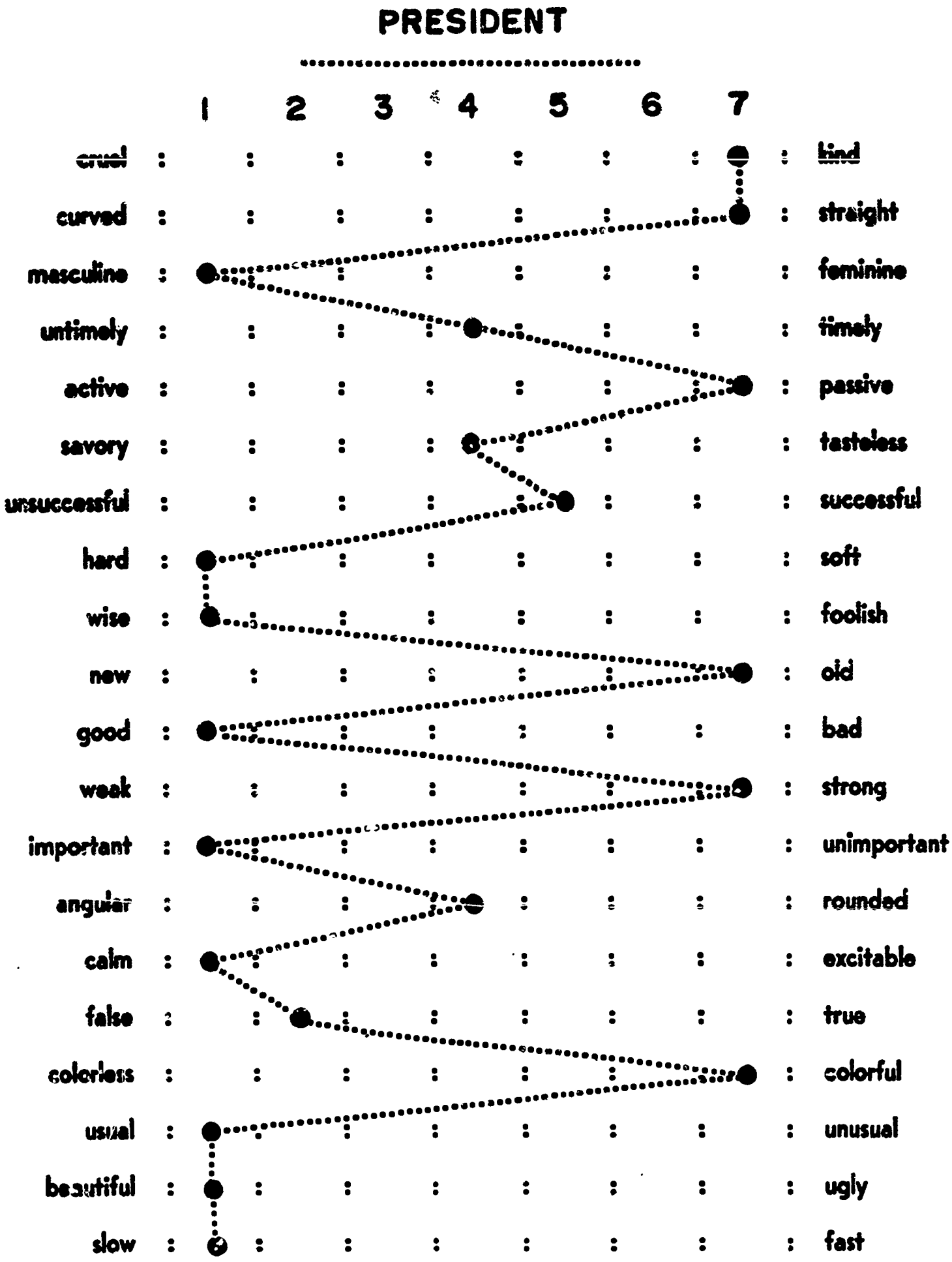

PRESIDENT
1 2 3 4 5 6 7
cruel : kind
curved : straight
masculine : feminine
untimely : timely
active : passive
savory : tasteless
unsuccessful : successful
hard : soft
wise : foolish
new : old
good : bad
weak : strong
important : unimportant
angular : rounded
calm : excitable
false : true
colorless : colorful
usual : unusual
beautiful : ugly
slow : fast

Figure 1

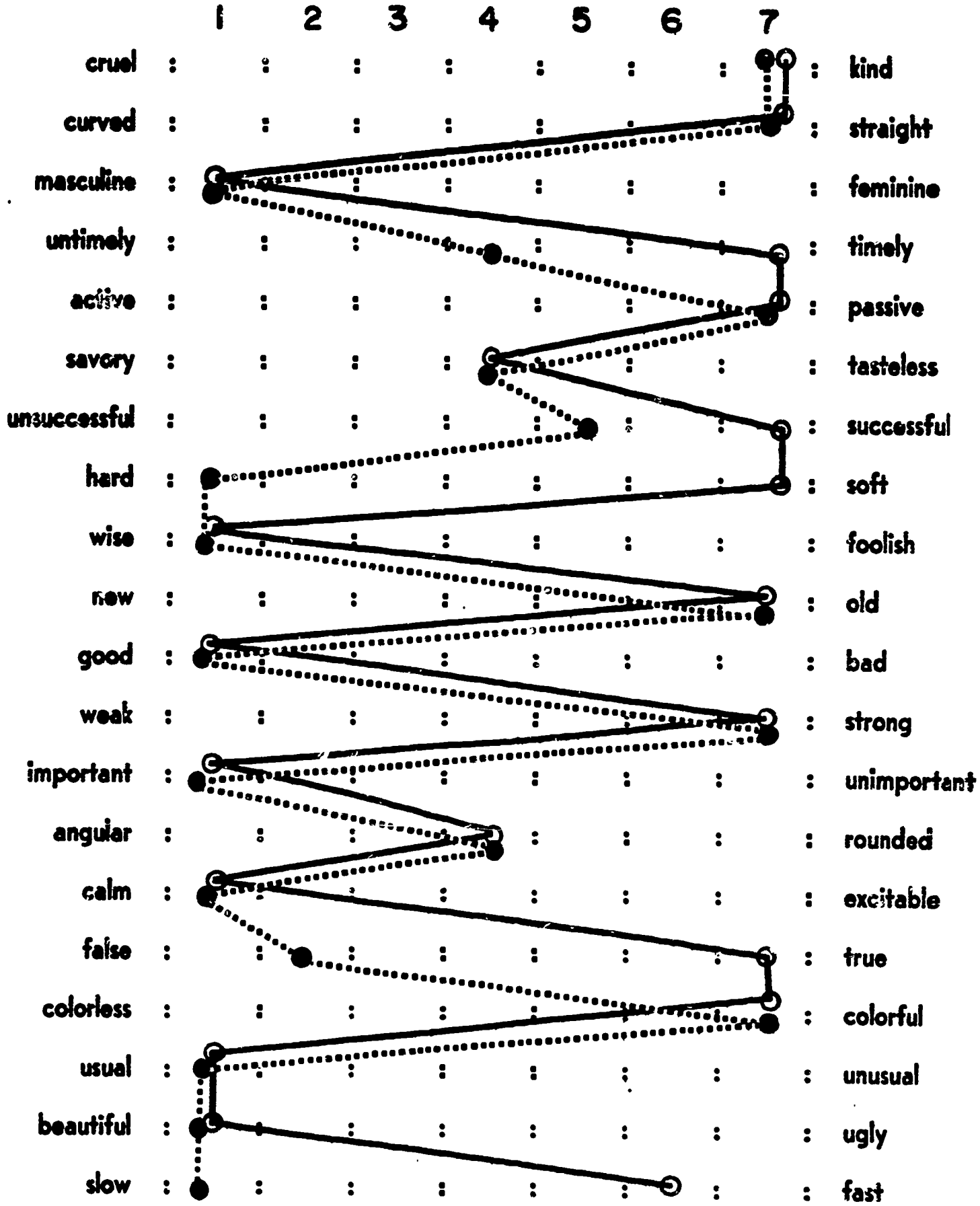

PRESIDENT / GUARD
1 2 3 4 5 6 7
cruel : kind
curved : straight
masculine : feminine
untimely : timely
active : passive
savory : tasteless
unsuccessful : successful
hard : soft
wise : foolish
new : old
good : bad
weak : strong
important : unimportant
angular : rounded
calm : excitable
false : true
colorless : colorful
usual : unusual
beautiful : ugly
slow : fast

Figure 2

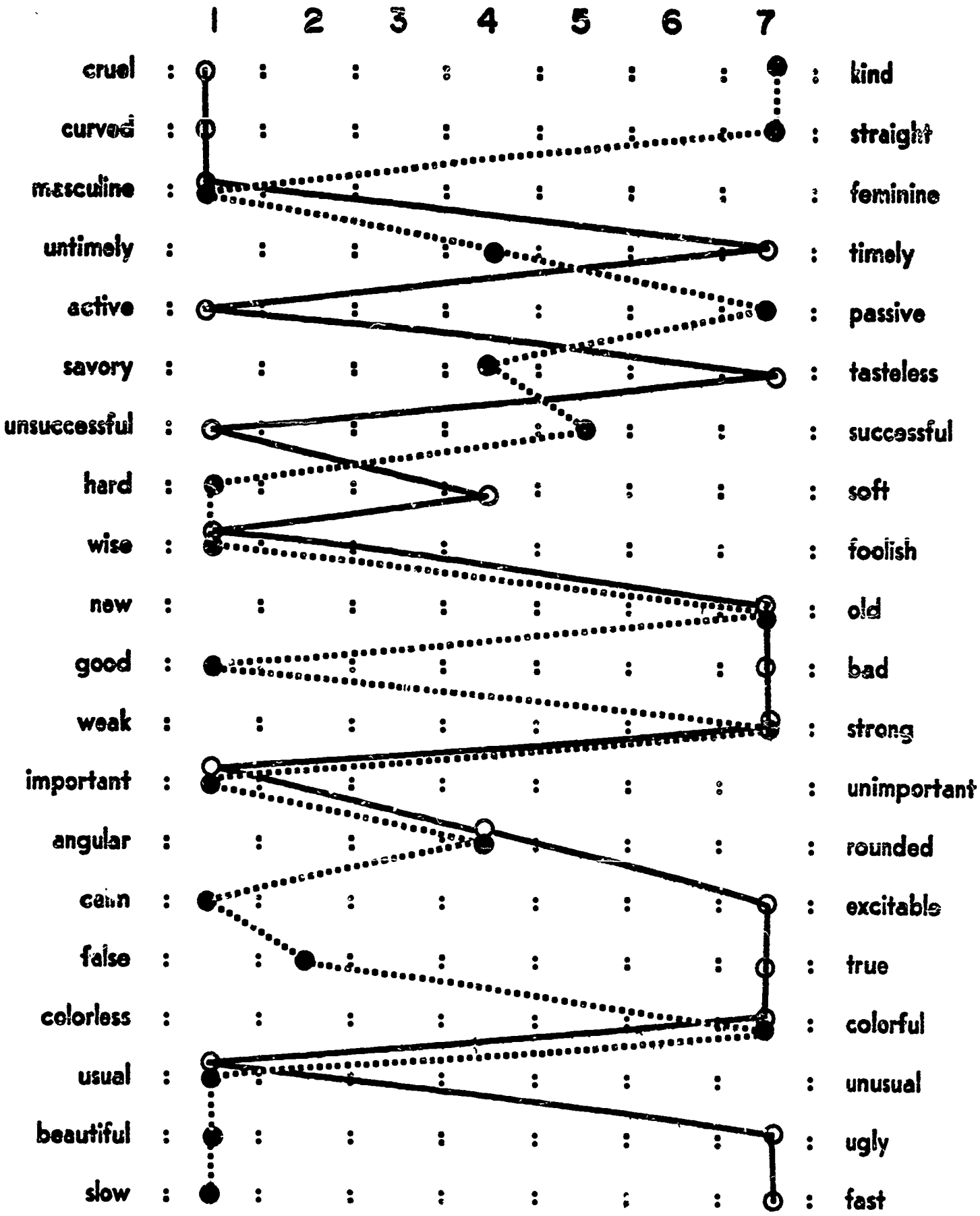

PRESIDENT / COMMUNIST
1 2 3 4 5 6 7
cruel : : : : : : : : kind
curved : : : : : : : : straight
masculine : : : : : : : : feminine
untimely : : : : : : : : timely
active : : : : : : : : passive
savory : : : : : : : : tasteless
unsuccessful : : : : : : : : successful
hard : : : : : : : : soft
wise : : : : : : : : foolish
new : : : : : : : : old
good : : : : : : : : bad
weak : : : : : : : : strong
important : : : : : : : : unimportant
angular : : : : : : : : rounded
calm : : : : : : : : excitable
false : : : : : : : : true
colorless : : : : : : : : colorful
usual : : : : : : : : unusual
beautiful : : : : : : : : ugly
slow : : : : : : : : fast

Figure 3

	Christian life	Down the drain	Fight	Lie	Marijuana	Trouble	Strange feeling	Vision
Christian life	0	120	430	690	690	560	150	60
Down the drain	120	0	430	590	590	520	170	160
Fight	430	430	0	360	360	410	440	490
Lie	690	590	360	0	200	430	680	730
Marijuana	690	590	360	200	0	310	660	750
Trouble	560	520	410	430	310	0	510	500
Strange feeling	150	170	440	680	660	510	0	90
Vision	60	160	490	730	750	500	90	0

Figure 4

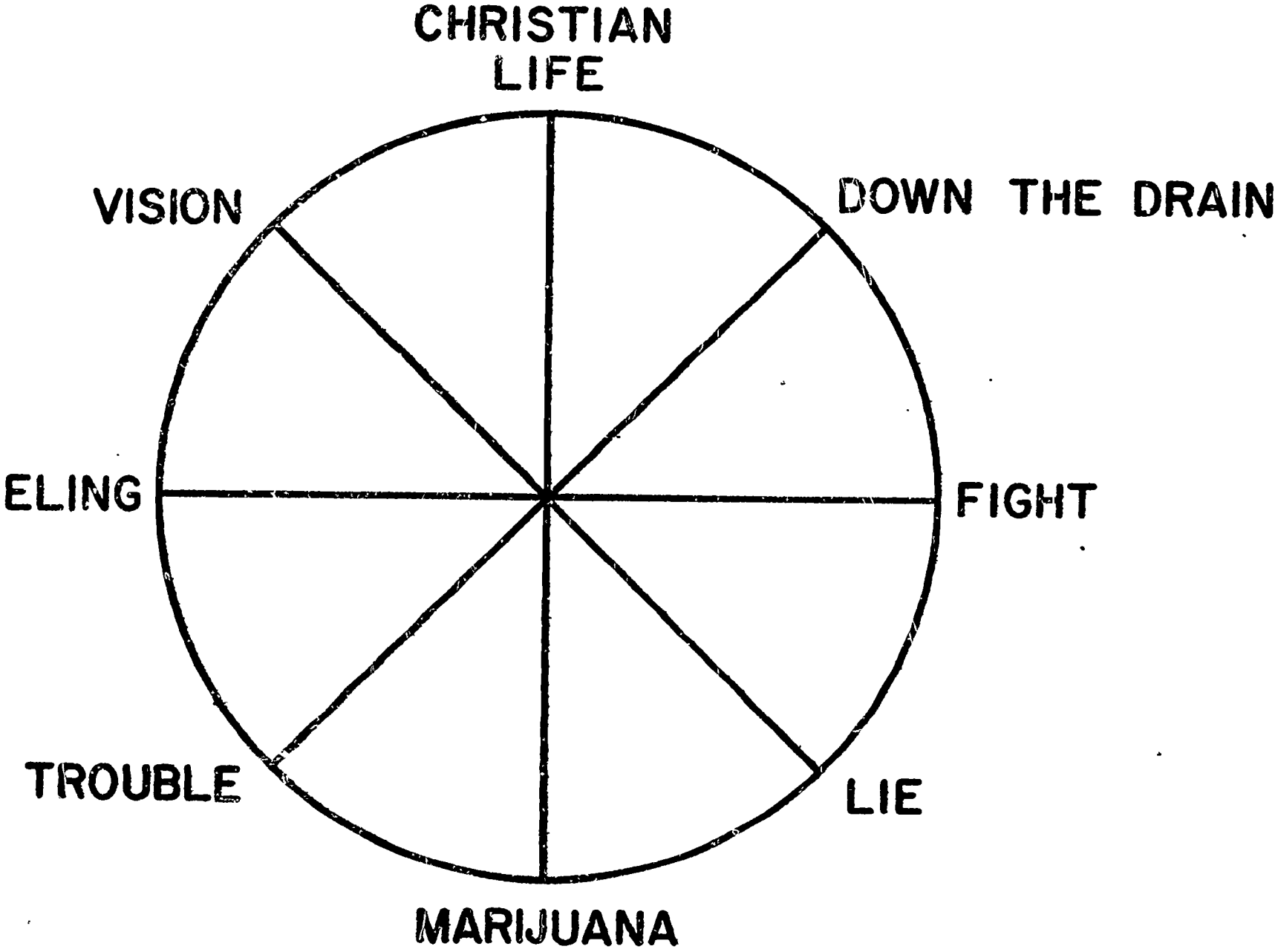

CHRISTIAN LIFE
VISION
DOWN THE DRAIN
STRANGE FEELING
FIGHT
TROUBLE
LIE
MARIJUANA

Figure 5

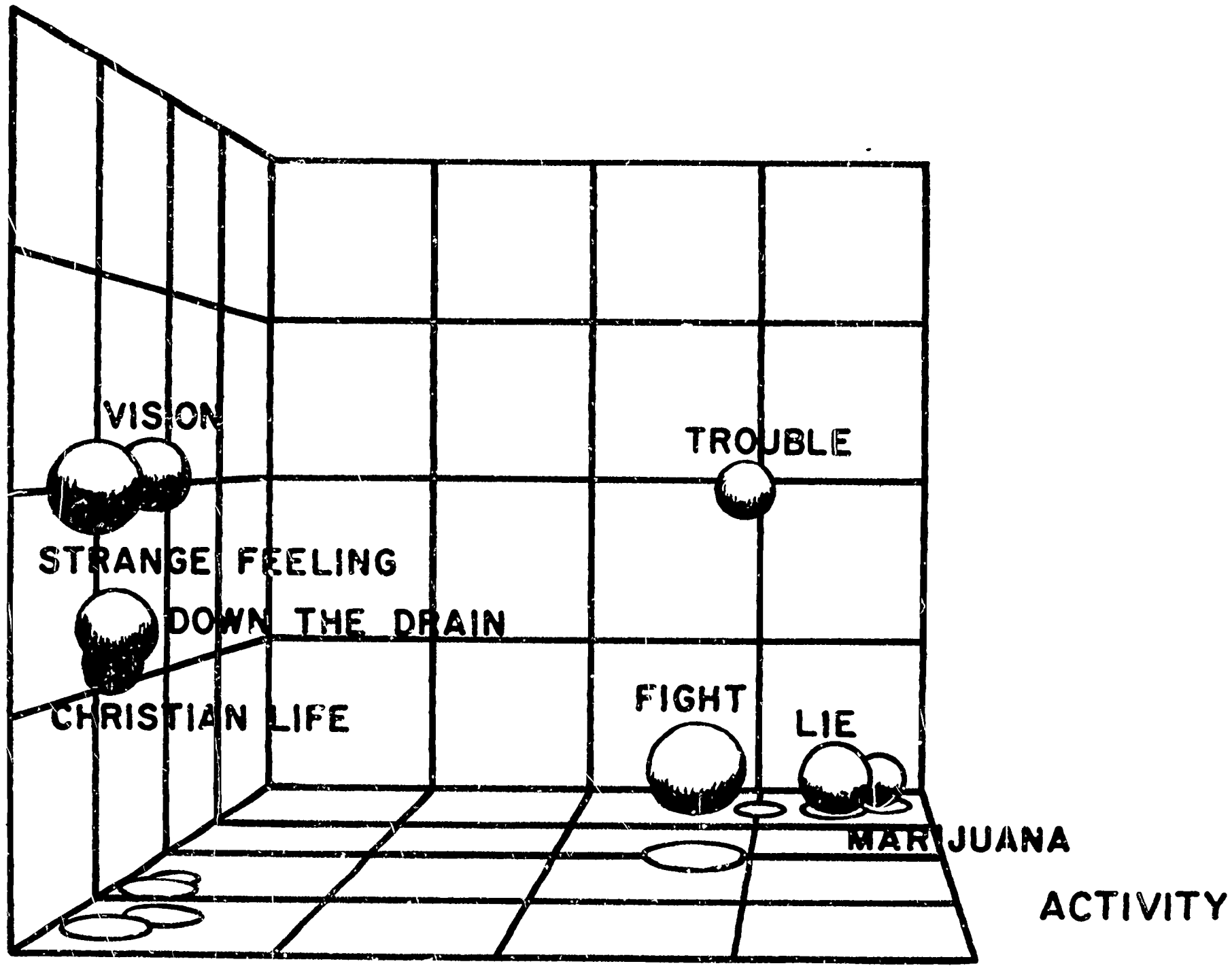
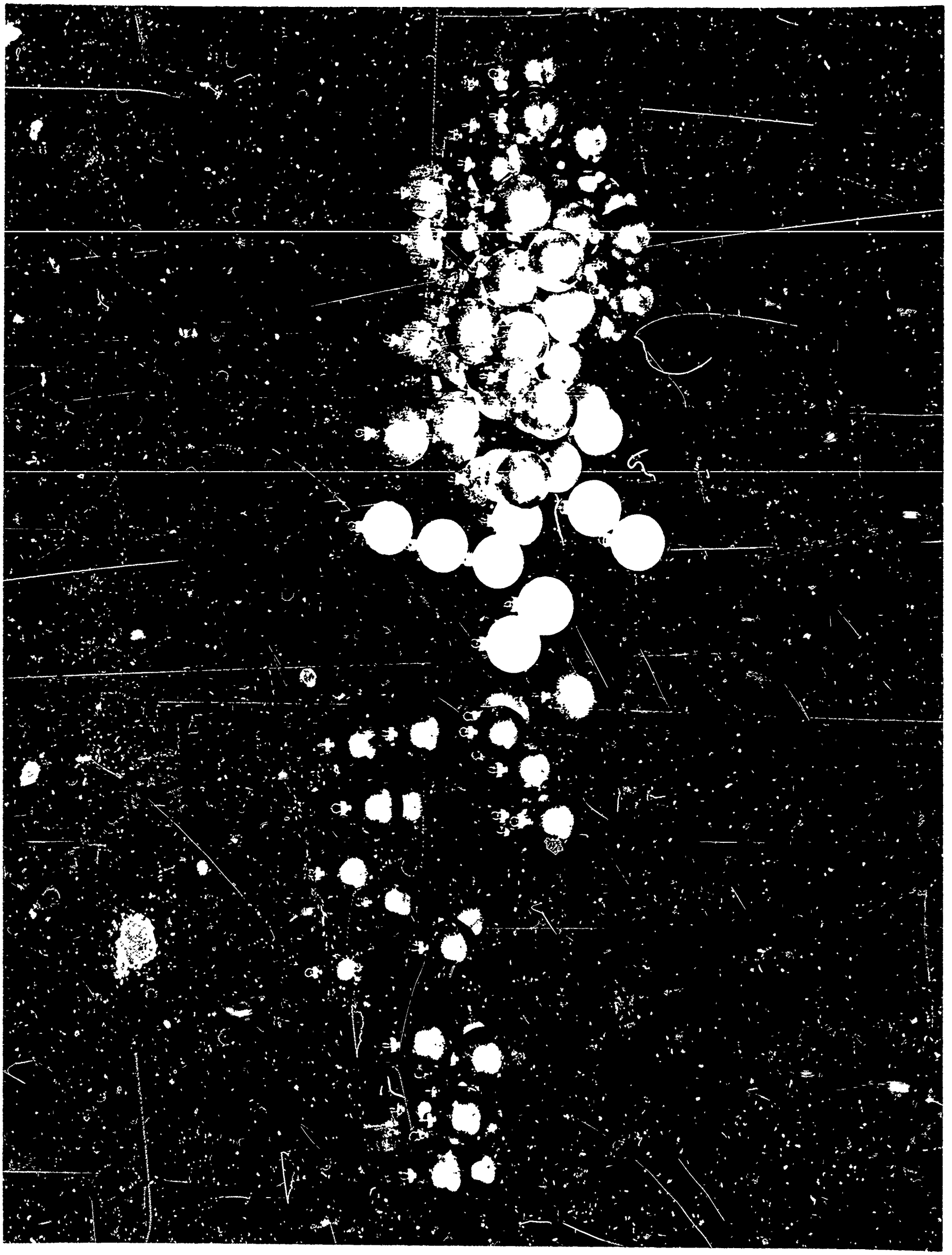

POTENCY
VISION
TROUBLE
STRANGE FEELING
DOWN THE DRAIN
CHRISTIAN LIFE
FIGHT
LIE
MARIJUANA
ACTIVITY
EVALUATIVE

Figure 6



(8) Patient's self-rating
(55) Every man's got a JOB to do
(77) I don't know what the Lord's got PLANNED FOR ME
(75) The man asked for my OPINION
(103) God's warning you to STRAIGHTEN UP
(67) When I was a child ... but when I became a man
(94) I'm going back to SCHOOL
(43) He'd make a GOOD SOLDIER
(76) He started on the PARADE FIELD and I prayed
(34) God wanted me TO EXPERIENCE all these things
(124) I've got a lot to do because I'm YOUNG
(36) I get FED UP sitting around
(13) The CHOSEN ONES see strange things
(49) I started HELPING the men

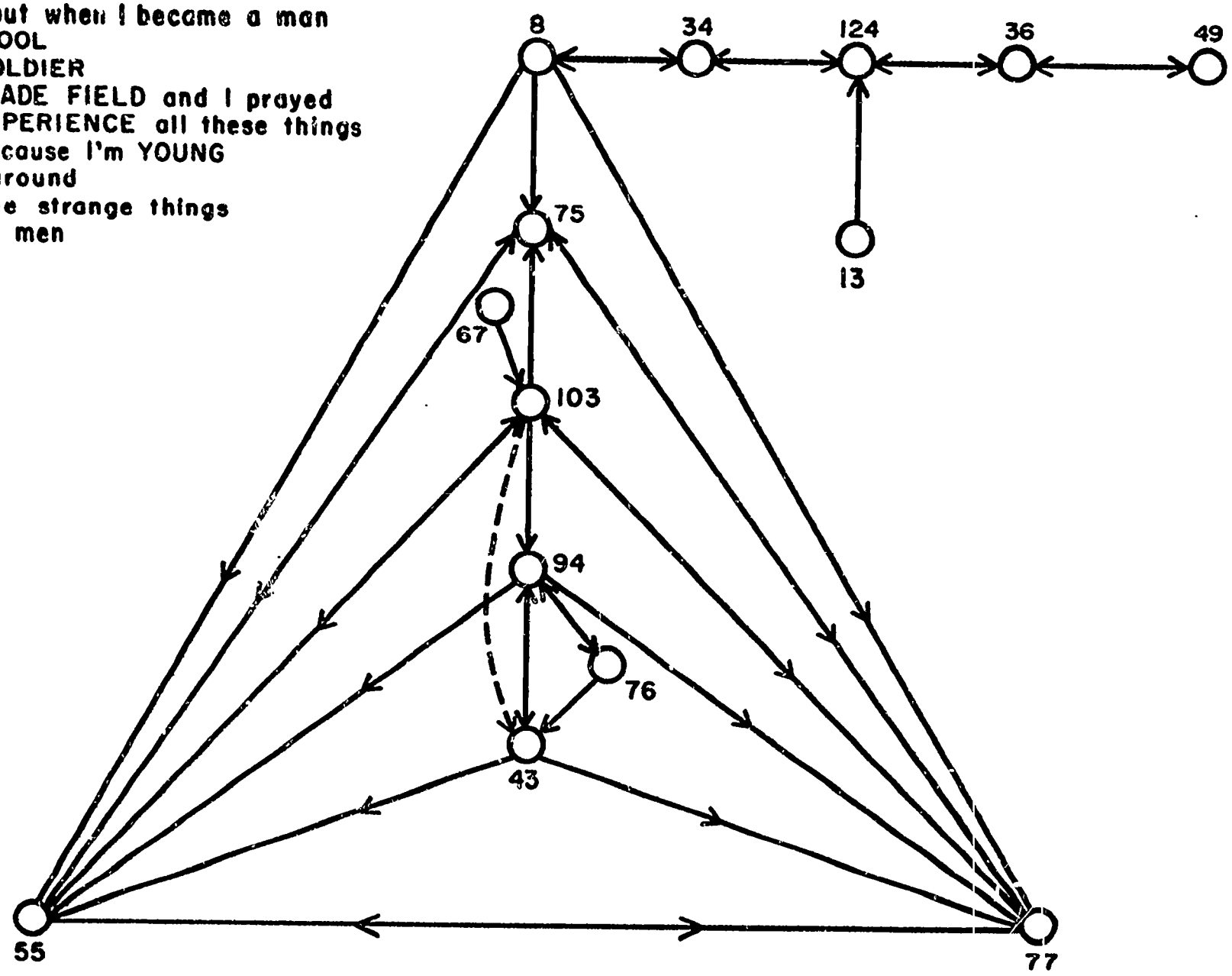


Figure 8

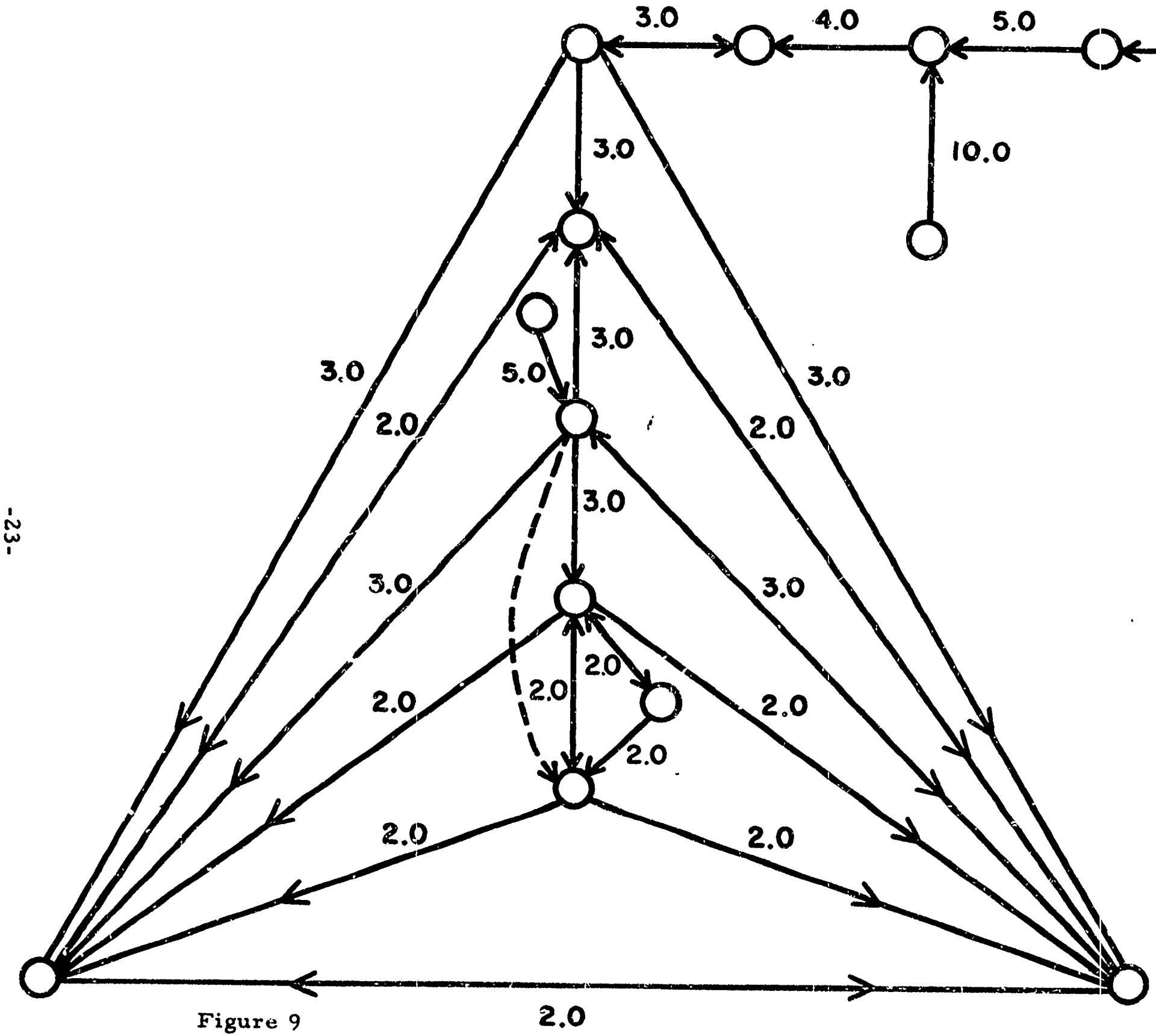
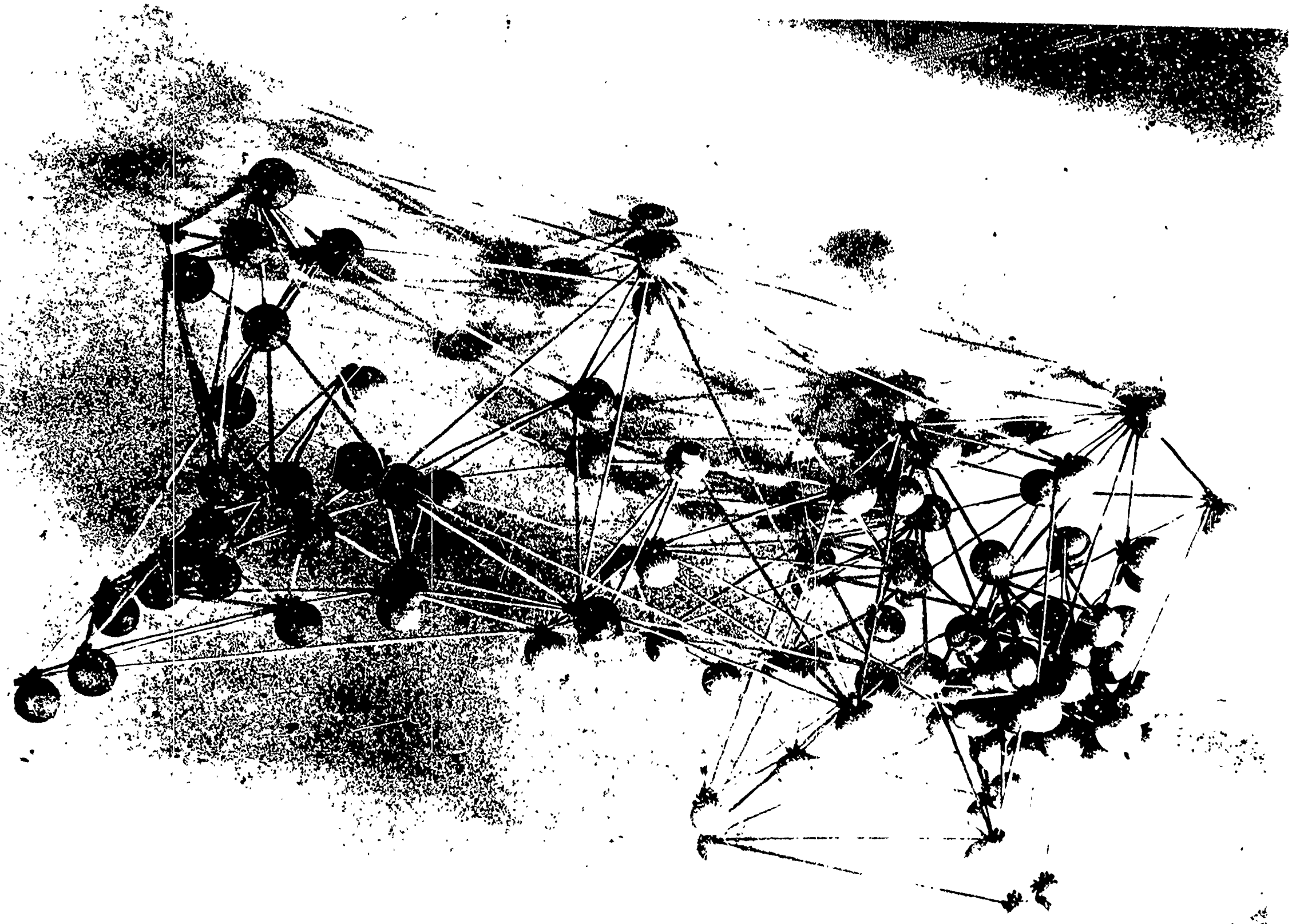
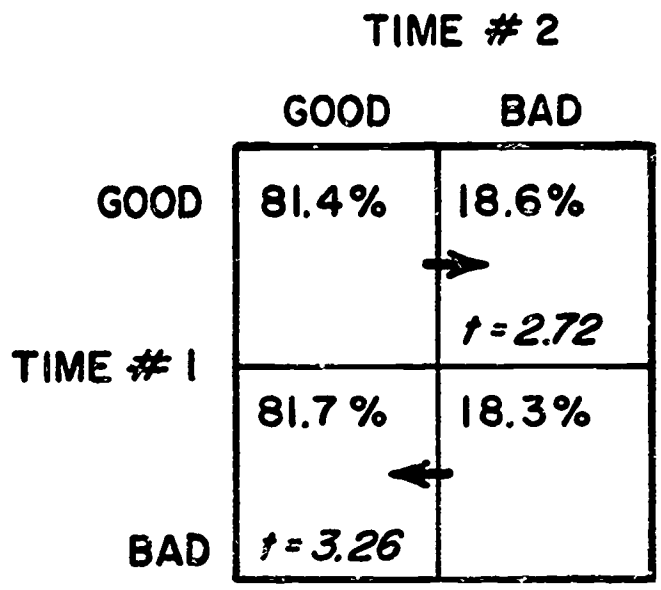


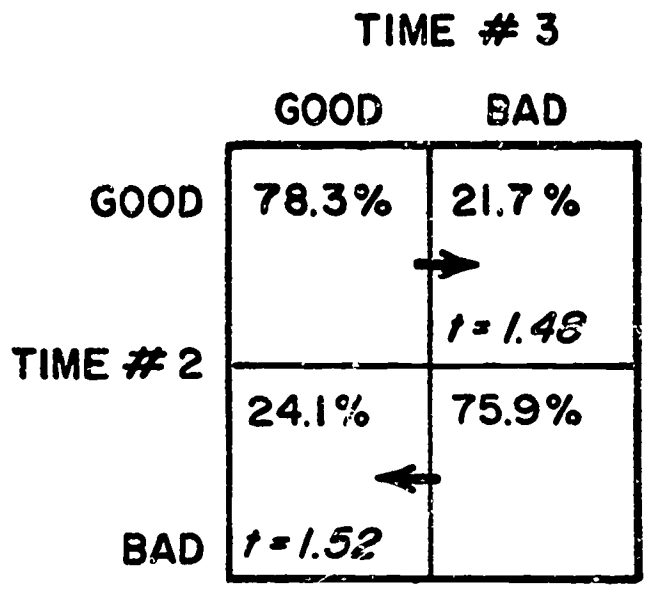
Figure 9



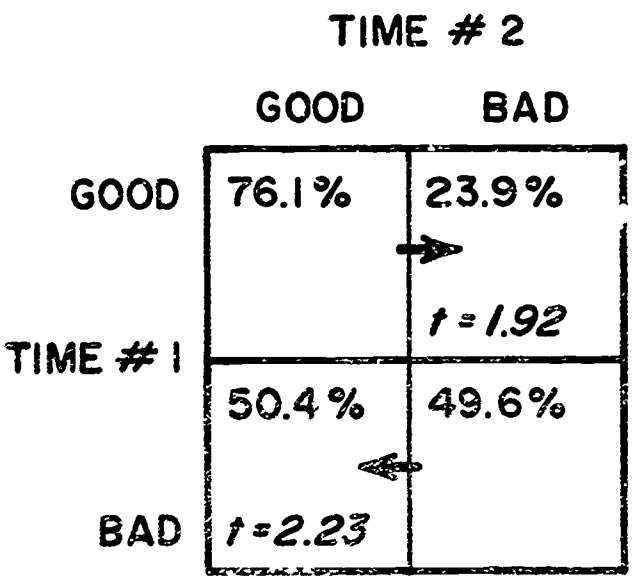
TURN-OVER TABLES FOR CHANGES IN EVALUATIVE MEANING

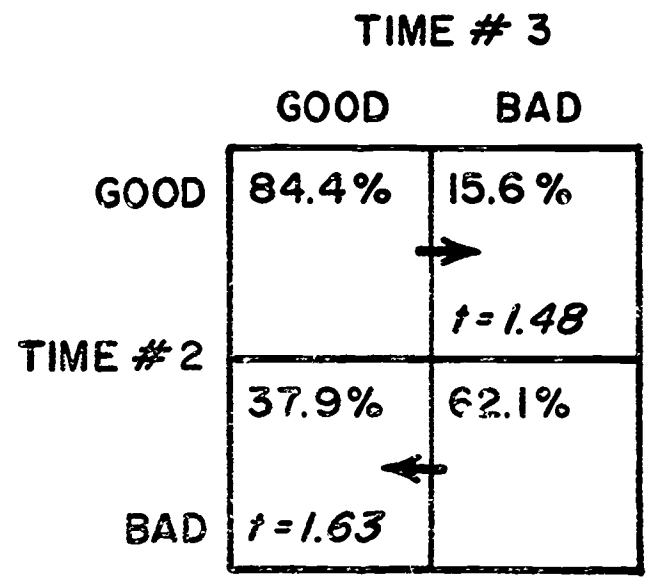
INTERVIEW I



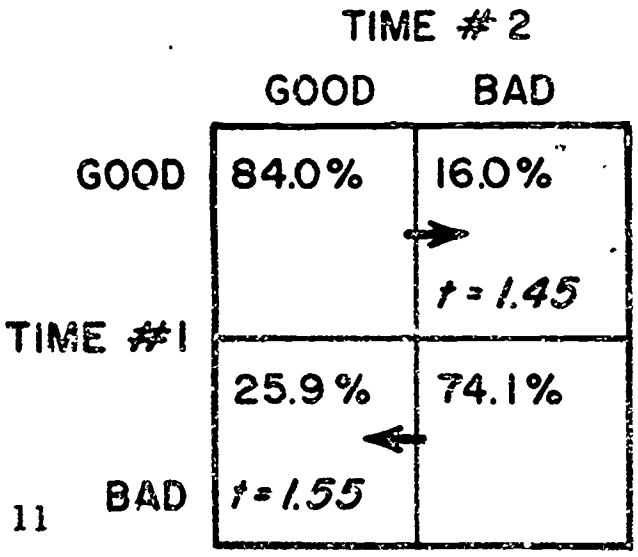


INTERVIEW II





INTERVIEW III



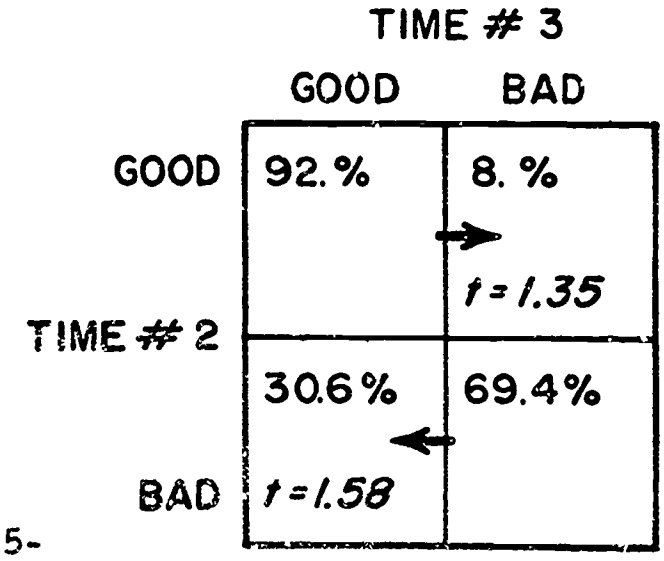


Fig. 11